



Calhoun: The NPS Institutional Archive
DSpace Repository

Theses and Dissertations

1. Thesis and Dissertation Collection, all items

1996-06

Performance measures for Military Sealift Command's Special Mission Oceanographic Ships

Jung, John D.

Monterey, California. Naval Postgraduate School

<http://hdl.handle.net/10945/32091>

Downloaded from NPS Archive: Calhoun



<http://www.nps.edu/library>

Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community.

Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

**PERFORMANCE MEASURES FOR
MILITARY SEALIFT COMMAND'S
SPECIAL MISSION OCEANOGRAPHIC SHIPS**

by

John D. Jung

June 1996

Co-Advisors:

William R. Gates
David G. Brown

Approved for public release; distribution is unlimited.

19960809 026

DTIC QUALITY INSPECTED

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY <i>(Leave blank)</i>	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED	
	June 1996	Master's Thesis	
4. TITLE AND SUBTITLE PERFORMANCE MEASURES FOR MILITARY SEALIFT COMMAND'S SPECIAL MISSION OCEANOGRAPHIC SHIPS			5. FUNDING NUMBERS
6. AUTHOR(S) Jung, John D.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT <i>(maximum 200 words)</i> This thesis suggests measures of performance MSC could use to monitor ongoing improvements in the Special Mission Oceanographic Ship program. A literature review was conducted to establish the importance of measures and propose a process for their development. Interviews with NAVOCEANO and COMNAVMETOCCOM personnel determined customer needs and their expectations concerning service quality. Using this input, a list of performance measures was synthesized. Interviews of MSCLANT and MSCPAC personnel determined the measures currently tracked. The developed measures were compared to the measures currently tracked to reveal holes or overlap. Finally, specific customer issues with service were addressed. Research found that MSC does not currently measure performance in these areas. Proposed measures were highlighted that would track performance improvement in these areas.			
14. SUBJECT TERMS Measures, Metrics, Military Sealift Command, Special Mission Program, Special Mission Ships			15. NUMBER OF PAGES 104
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)

Prescribed by ANSI Std. Z39-18 298-102

Approved for public release; distribution is unlimited.

**PERFORMANCE MEASURES FOR MILITARY SEALIFT COMMAND'S
SPECIAL MISSION OCEANOGRAPHIC SHIPS**

John D. Jung
Lieutenant Commander, United States Navy
B.S., Mankato State University, 1984

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1996

Author: _____
John D. Jung

Approved by: _____
William R. Gates, Thesis Co-Advisor

David G. Brown, Thesis Co-Advisor

Reuben T. Harris, Chairman
Department of Systems Management

ABSTRACT

This thesis suggests measures of performance MSC could use to monitor ongoing improvements in the Special Mission Oceanographic Ship program. A literature review was conducted to establish the importance of measures and propose a process for their development. Interviews with NAVOCEANO and COMNAVMETOCOM personnel determined customer needs and their expectations concerning service quality. Using this input, a list of performance measures was synthesized. Interviews of MSCLANT and MSCPAC personnel determined the measures currently tracked. The developed measures were compared to the measures currently tracked to reveal holes or overlap. Finally, specific customer issues with service were addressed. Research found that MSC does not currently measure performance in these areas. Proposed measures were highlighted that would track performance improvement in these areas.

This thesis research found that there are some elements of performance important to the customer which are not being tracked by MSC. Secondly, it is important to involve MSC personnel, their customers and suppliers, etc. in identifying and developing measures for improvement monitoring. Finally, measures identify problems and quantify the improvement made in performance. A measurement system alone won't correct problems.

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	BACKGROUND	1
1.	United States Transportation Command (USTRANSCOM)	1
2.	Military Sealift Command	2
3.	MSC's Reinvention	3
4.	Special Missions Program	4
B.	RESEARCH OBJECTIVE	4
C.	RESEARCH SCOPE	5
D.	METHODOLOGY	6
E.	ORGANIZATION OF THESIS	6
II.	LITERATURE REVIEW	9
A.	MEASURES OVERVIEW	9
B.	ROLES OF MEASUREMENT	10
1.	Measurement to Ensure Strategy is Implemented	10
2.	Measurement As a Management Support System	11
3.	Measurement as a Control Device	11
4.	Measurement for Improvement	11
C.	THE NEED FOR NEW MEASURES	12
D.	DEVELOPING MEASURES	14
E.	MEASUREMENT CRITERIA / CATEGORIES	18

1. Sink and Tuttle's Performance Criteria	
Categories	19
a. Effectiveness	20
b. Efficiency	21
c. Quality	22
d. Productivity	24
e. Quality of Work Life (QWL)	25
f. Innovation	26
g. Profitability/Budgetability	26
h. Interrelationships Between the Seven Performance Criteria	27
2. Globerson's Performance Criteria	
Categories	28
a. Vertical Criteria	28
b. Horizontal Criteria	29
3. Brancato's Performance Criteria	
Categories	32
a. Customer Satisfaction	32
b. Workplace Practices	33
c. Relationships With Suppliers	34
d. Environmental Competitiveness and Safety	34
e. Innovation	35
4. Kaplan and Norton's Performance Criteria	
Categories	35
a. Customer Perspective	36

b.	Internal Business Perspective . . .	38
c.	Innovation and Learning	
	Perspective	38
d.	Financial Perspective	39
F.	SUMMARY	40
III. NAVOCEANO AND CURRENT METRICS		43
A.	NAVAL OCEANOGRAPHIC OFFICE	43
1.	Background	43
2.	NAVOCEANO Ships Managed by MSC	46
3.	NAVOCEANO'S Ship Operations	48
B.	WHAT MSC PROVIDES FOR NAVOCEANO	51
C.	MEASURES CURRENTLY TRACKED BY MSC	52
D.	ISSUES NAVOCEANO AND GAO HAVE WITH MSC SERVICE	55
1.	NAVOCEANO Issues	55
a.	Maintenance of Mission Related Deck Equipment (MRDE)	55
b.	Ship Configuration Management . . .	57
c.	MSC Overhead Costs	58
d.	MSC's Management of Sponsor Funds .	59
e.	Overstated Cost Estimates	60
f.	Ship Sighting Report	60
g.	Logistics	61
h.	Quality of Life	61
2.	GAO Audit Results	62

E. SUMMARY	63
IV. PROPOSED MEASURES	
A. MEASURES APPLICABLE TO OCEANOGRAPHIC SHIP	
MANAGEMENT	66
1. Customer Satisfaction	66
a. Ship Performance	66
b. Customer Service	67
c. Contract Compliance	68
d. Human Resources	69
2. Internal Business Perspectives	69
3. Innovation	70
4. Financial Perspective	71
B. PROPOSED MEASURES AND COMPARISON TO CURRENT	
MSC MEASURES	71
C. NAVOCEANO AND GAO ISSUES	74
1. NAVOCEANO Issues	74
2. GAO Audit Discrepancies	76
D. SUMMARY	77
V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	
A. SUMMARY	79
B. CONCLUSIONS	81
C. RECOMMENDATIONS	82
LIST OF REFERENCES	83

APPENDIX. DEFINITIONS	87
INITIAL DISTRIBUTION LIST	89

I. INTRODUCTION

This chapter provides a brief background on the U.S. Transportation Command (USTRANSCOM) and one of its component commands, Military Sealift Command (MSC). It then discusses MSC's reinvention process and introduces MSC's Special Mission Program. The research objectives, methodology and scope, and the thesis organization will follow.

A. BACKGROUND

1. United States Transportation Command (USTRANSCOM)

USTRANSCOM is the single manager responsible for the Defense Transportation System. It is a unified command, established under the Goldwater Nichols Act in 1987. It has three component commands: Military Sealift Command (Navy), Air Mobility Command (Air Force) and Military Traffic Management Command (Army). MSC provides USTRANSCOM common user Sealift Transportation for the entire Department of Defense (DoD) and operates the prepositioning ships. Air Mobility Command (AMC) provides the airlift services for USTRANSCOM. Finally, Military Traffic Management Command (MTMC) manages all DoD personnel and cargo movement overland and provides the interface between the DoD shippers and the commercial carriers. [Ref. 1: p. 9-11]

2. Military Sealift Command

Military Sealift Command is responsible to USTRANSCOM for providing all sealift transportation for DoD. MSC oversees a fleet of more than 130 ships in three separate forces; the Naval Fleet Auxiliary Forces (NFAF), the Strategic Sealift Force and the Special Mission Program.

[Ref. 2: p. 3] NFAF ships provide direct fleet support for the Navy's combatant ships, allowing them to extend their stay at sea. The Strategic Sealift Force deploys and sustains U.S. military forces worldwide. The Special Mission Program provides and operates ships for specialized military purposes. [Ref. 3]

MSC is headquartered in Washington, D.C. and has area commands located in Bayonne, NJ (MSCLANT); Oakland, CA (MSCPAC); London, (MSCEUR); and Yokohama, Japan (MSCFE). Future consolidations under the Base Realignment and Closure (BRAC) process include moving MSCLANT to Norfolk, VA, MSCPAC to Pearl Harbor, HI and MSCEUR to Naples, Italy. There are many other subcommands and offices located worldwide. Approximately 8,000 people make up MSC's workforce. This includes military, civil service and contract mariners.

[Ref. 1: p. 7-8]

MSC is a Defense Business Operations Fund (DBOF) activity. As such, it does not receive any direct appropriation funding. A revolving fund is established from

which payments are made for costs incurred. The fund is replenished by billing MSC's customers for services. DBOF activities do not make a profit but have a goal to break even. Shortfalls or surpluses are carried forward from year to year.

3. MSC's Reinvention

MSC is currently involved in a reinvention process in response to military downsizing and increasing pressure for government agencies to improve efficiencies and reduce costs. In February 1996, MSC implemented a program manager organizational structure designed around major service lines. This structure places more emphasis on the customer. The program management concept provides a mission specific group of people and resources who can provide quick response and increased flexibility in meeting the customer's requirements. [Ref. 2: p. 3-5]

The following vision statements serve as guidelines during MSC's restructuring effort:

- To provide uniformly high customer service;
- To have clear communication channels;
- To clarify and align accountability, responsibility and authority;
- To streamline and eliminate duplication;
- To be proactive;
- To provide uniformly high organizational flexibility and responsiveness;

- To pursue growth opportunities;
- To take care of our people. [Ref. 2: p. 5]

4. Special Missions Program

MSC's Special Missions Program is one of six program areas under the new structure. [Ref. 2: p. 5] The program's mission is "[t]o manage, operate, repair and maintain MSC's fleet of Special Mission Ships which perform various special missions for the Department of Defense customers." [Ref. 2: p. 13] It consists of 29 ships, including 10 TAGOS, eight oceanographic ships, five range/cable ships and six chartered ships (Chouest owned). Two program officers, one for TAGOS ships and the other for range/cable/oceanographic ships, report to the program manager (PM-2). Various detachments throughout the United States will support the program officers in the daily operations.

B. RESEARCH OBJECTIVE

This thesis will develop a set of measurement criteria to monitor the improvements made in MSC's Special Mission Oceanographic Ship program under the new program management structure. These can be used to measure the efficiency and effectiveness of operations and the impact of organizational changes. They can also provide an efficiency incentive for the program management staff. Using data collected from MSC's customers, an independent set of measures will be

developed and compared with MSC's current measures. The result will be a set of measures which can be used, not only for the oceanographic ships, but potentially across all business areas of the MSC Special Mission Program.

The goal of this thesis research is to answer the following research questions:

Primary:

What appropriate measures of performance can MSC use to monitor ongoing improvements in the Special Mission Oceanographic Ship program?

Subsidiary:

What aspects of service are important to MSC's oceanographic ship customers?

What aspects of service does MSC perceive to be important to its customers?

C. RESEARCH SCOPE

A literature review of performance measures provides the foundation for developing four measurement criteria to monitor performance improvement in MSC's Special Mission Oceanographic Ship Program. The study identifies performance measures currently used by MSC and proposes additional measures based on customer service preferences. This thesis is limited to the oceanographic ships.

D. METHODOLOGY

The goal of this thesis is to develop performance criteria which can be applied to MSC's Special Mission program. A literature review establishes the importance of measures and proposes a process for their development. Information was collected through interviews with NAVOCEANO and COMNAVMETOCOM personnel to determine customer needs and their expectations concerning service quality. Interviews with MSCLANT and MSCPAC personnel determined the measures currently tracked. The developed measures were compared to the list of measures currently tracked to reveal any holes or overlap. Finally, specific customer issues with service were addressed. Research found that MSC does not currently measure performance in these areas. Proposed measures were suggested to track performance improvement in these areas. Finally, the potential for applying these four broad measurement criteria to other areas of the Special Mission Program was discussed.

E. ORGANIZATION OF THESIS

This thesis is organized as follows:

Chapter I: Introduction

Chapter II: Literature Review

Chapter III: NAVOCEANO and Current Metrics

Chapter IV: Proposed Measures

Chapter V: Summary, Conclusions and Recommendations

Chapter I introduces MSC, their mission, the current reinvention efforts underway to increase customer satisfaction and the need for measures. Chapter II presents a literature review which establishes the foundation for the performance measures, what they are, their importance, problems with the traditional financial measures and the need for organizations to establish new performance measures to stay competitive in today's business environment. An overview of the measurement criteria presented by various authors is discussed. From their proposed measures, a list of four broad measurement criteria is synthesized. These categories can be applied to MSC's Special Mission Oceanographic Ship Program. Chapter III introduces NAVOCEANO, its mission and some background on the ships that are managed by MSC. This chapter also describes what services MSC provides, what measures MSCLANT and MSCPAC are currently tracking and concerns with regard to MSC services. Chapter IV proposes a set of measures to track improvements in MSC's management of Special Mission Oceanographic Ships. Finally, Chapter V provides a summary, conclusions and recommendations.

II. LITERATURE REVIEW

A. MEASURES OVERVIEW

Mankind measures because there is an inherent human desire for feedback - how did we do [Ref. 4: p. 141]?

According to Sink [Ref. 5: p. 65]:

If we want to know something about a particular phenomenon, we measure certain attributes: its size, color, shape, temperature, magnitude, weight, state, quality, and so forth. If our intent is casual or not particularly critical, we do not spend much time, effort, or resources on measurement. However, if the particular phenomenon is of great interest, then typically we attempt to be precise and accurate in our efforts to measure or specify its characteristics.

Sink and Tuttle describe the measurement process as "deciding what constitutes performance and then tracking indicators against our concepts of performance...." [Ref. 4: p. 144]. They also state that "...measurement is a substitute for, or can at least enhance, direct observation" and "...measurement can give us visibility where it might otherwise be difficult" [Ref. 4: p. 158].

The purpose of this chapter is to build the foundation for the thesis by providing a background of what various experts say about measures and how they are used. A description of the various roles measurement can fulfill follows. The need for new measures will be discussed along with what many authors consider to be the shortcomings of traditional measurements. The following section presents

guidelines which can aid organizations in developing measures. Finally, the measurement criteria proposed by various authors are reviewed. The summary for this chapter will introduce a set of general measurement categories which will be used to shape the specific measurement categories for MSC in Chapter IV.

B. ROLES OF MEASUREMENT

Measurement plays a variety of roles in the management process. Sink and Tuttle [Ref. 4: p. 144] describe in detail the various roles measurement can take on, such as: ensuring strategy is implemented, a management support system, a control device, and for improvement. A brief overview of Sink and Tuttle's important points concerning each of these roles follows.

1. Measurement to Ensure Strategy is Implemented

Organizations must ensure that, when developing a measurement system, it reflects and is influenced by their business strategies. Developing measures which are specifically linked to the organization's goals, objectives and strategies forces those responsible for implementation to think through costs and benefits, cause-and-effect linkages, and implications of the strategy. [Ref. 4: p. 150]

2. Measurement As a Management Support System

A management control system provides the manager the critical information required for deciding what to do, how to do it, directing and evaluating performance and finally, deciding what should be changed. Measurement is the foundation for developing these support systems. The maturity and complexity of the measurement systems are linked to the complexity of the system being managed. [Ref. 4: p. 152]

3. Measurement as a Control Device

This is considered to be the most familiar and widely used method for measurement. It consists of measurement, evaluation, and intervening or exerting influence on the thing being measured in an attempt to control. Control is not an output but an outcome resulting from the intervention. [Ref. 4: p. 155]

4. Measurement for Improvement

Sink and Tuttle believe the most important reason for measuring performance is to support and enhance improvement. Measurement can reveal system capabilities and what expected performance levels are statistically probable from the organization's processes and systems. Sink and Tuttle also state the following:

Measurement can tell us where we need improvement, it can help us to prioritize where to devote our

energies and resources, it can motivate, it can tell us when we've gotten better, and it is a natural and inherent part of the management process. Good, high-quality measurement systems don't just happen; they must be designed and developed and maintained. Well-designed and developed measurement systems linked to a business strategy that is understood and accepted can drive constant performance improvement. [Ref. 4: p. 149]

As previously mentioned, Sink and Tuttle, along with other authors, consider measurement for improvement to be the most important role. This thesis will be based on that premise.

C. THE NEED FOR NEW MEASURES

Measures have taken on a renewed importance in recent years. Businesses faced with growing global competition are restructuring to reduce costs, improve process management, and increase quality and customer satisfaction. To succeed in a global marketplace, they must perform as well as the world's best. The performance level of the world's best is constantly rising due to improvements in technology, communications, and learning.

Many types of organizations that are entrenched in empire building and maintaining the status quo, such as government, health care, utilities, and transportation, are now facing competition due to deregulation and budget cuts. A critical success factor for all of these organizations is the ability to accomplish rapid improvement based on

continuous learning, or for some, a step-change in performance. [Ref. 6: p. 19]

The recent sense of urgency among government agencies to become more competitive also reflects Public Law 103-62, the Government Performance and Results Act (GPRA), signed by President Clinton in 1993. GPRA "mandates full participation by all agencies in strategic planning (mission statements and long term goals) and performance measurement by fiscal year 1999" [Ref. 7: p. 7].

At the same time, many companies report a need to develop key performance measures to augment the traditional quarterly and annual financial measures. These incorporate both financial and non-financial measures. The traditional accounting and financial measures were designed long ago, not to run businesses, but to meet financial and regulatory reporting requirements [Ref. 6: p. 7]. According to Dr. Ivor S. Francis, director of the Deming Centre International in Australia:

Traditional measures of accounting are inadequate to understand how a company creates value. Companies may spend vast sums accounting for present fixed assets which may represent but a small proportion of the present financial value of the company; at the same time, the company's accountants may ignore those intangible assets which determine the production of future wealth. Measuring performance must entail measurement of the potential for future performance, not last year's performance. [Ref. 6: p. 13]

Shortcomings in traditional accounting-based measures are

listed by Brancato :

[I]n comparison to key measures of performance, traditional accounting based measures:

- are too historical;
- lack predictive power;
- reward the wrong behavior;
- are focused on inputs and not on outputs;
- do not capture key business changes until it is too late;
- reflect functions, not cross-functional processes, within a company; and
- give inadequate consideration to difficult-to-quantify resources such as intellectual capital.

[Ref. 6: p. 17]

D. DEVELOPING MEASURES

Most of the authors agree that measures should be born out of strategy. Organizations need to first define their vision or goals. They should identify their unique business niche, the basis of their competitive edge, and things they must do to succeed. Then, through an evaluation process, personnel translate the organization's strategic objectives into a logically consistent set of performance measures.

The authors generally agree that it is best to start with a blank sheet of paper in order to ignore all of the performance measures currently tracked, thereby ensuring a higher success rate. They may return to some of their list of existing measures at a later time, if necessary, to fill in any gaps discovered. [Ref. 6: p. 35]

Various authors have provided guiding principles to use when developing performance improvement measures. What

follows is an overview of ideas presented by Sink and Tuttle [Ref. 4], Brancato [Ref. 6], and Globerson [Ref. 8].

Sink and Tuttle present 16 guiding principles which they view as important to compete with, "The New Competition." The four that are presented here are considered the most important. Foremost, they state that "measurement cannot be used to drive performance improvement—the driver must be the business strategy and the performance improvement plan." [Ref. 4: p. 211] To support this point Sink and Tuttle stress that the largest hurdle managers must overcome is to accept the fact that to remain competitive in today's world requires constant performance improvement. Only after that will measurement become a necessary tool to guide successful performance improvement decision making.

The second principle states that "acceptance of the measurement process is essential to its success as a performance improvement tool." [Ref. 4: p. 212] The key point that they and other authors have echoed is that involvement by all employees in the planning and implementation process will enhance acceptance, provide a more relevant set of performance measures, and maximize performance results.

Sink and Tuttle's third principle, "measure what's important—not what's easy to measure" stresses the need to

measure the "right" things. [Ref. 4: p. 212] People perceive important things to be what is measured and will direct resources and performance down that same path. Perhaps this is best summed up another way by Sink and Tuttle when they state "you get what you inspect, not what you expect" [Ref. 4: p. 142].

Finally, Sink and Tuttle recommend "adopt an experimental approach to measurement systems for improvement." They quote from Tom Peters' book, *In Search of Excellence*, to encourage organizations to avoid delaying implementation of measures until they are perfect. To ensure success it is best to develop the best measures possible, try them out, then change them if necessary. [Ref. 4: p. 212]

Brancato [Ref. 6: p. 40] provides a number of principles collected by numerous business executives who have successfully developed performance improvement measures:

- Choose measures which best describe the outcome or accomplishment you expect.
- An organization can focus on what's important by limiting the number of measures.
- Limit the measurement precision to only those items which will provide a payback.
- A few measures to cover an area of interest will provide a more accurate picture than one global measure.
- To maximize change and improvement, develop measures

that are group oriented and avoid linking them to individual employee performance measures.

- Continually raise the performance standards.
- Don't be afraid to change the measures as strategy changes.

Globerson [Ref. 8: p. 39] provides ten factors which he considers important for relevant criteria development:

- Developing performance criteria based on the organization's objectives forces managers to define them in concrete terms.
- Management is able to conduct performance comparisons for similar areas as a result of established relevant performance criteria.
- Involving customers, management and employees in the criteria selection process is key to ensuring the selected criteria meet the needs of the entire organization.
- Criteria must be measurable and concise in order to be valid and useful.
- Criteria must be appropriate for the organizational unit being evaluated to be valuable.
- Both ratio criteria and absolute criteria are necessary when evaluating organizations.
- Although objective criteria are preferred and reliable, subjective criteria are necessary for measuring service.
- The measurement must be reliable to ensure consistent and accurate results.
- Precision in selecting and using calculation methods is critical.
- Measurement criteria should be selected based on relevancy, not ease of use.

E. MEASUREMENT CRITERIA / CATEGORIES

This section explains the relationship between measurement criteria and individual attributes. It also reviews the measurement criteria categories proposed by various authors as well as the reasons why these are believed to be important.

Sink and Tuttle [Ref. 4: p. 136] and Kaplan and Norton [Ref. 9: p. 72] both liken an organization's performance measurement criteria to instrument clusters in an aircraft cockpit (ie: aircraft position, communication, navigation and engine performance) and the elements of those criteria to the individual instruments and gauges. Just as an instrument cluster informs the pilot of the overall engine status, measuring a combination of individual attributes will give the manager the big picture on that aspect of performance. As the whole instrument panel tells the current status of the plane, the combination of performance criteria helps the management team to manage effectively. Relying on only one instrument or measure can spell disaster.

Similar to designing an aircraft instrument panel, it is important to design a measurement system by starting at the general level and work towards the detailed. This ensures the organization has a conceptual level of understanding to guide them through the process. Starting

at a lower level of detail greatly increases the possibility of disaster. Once the criteria has been defined it is best left up to those actually involved with the process to develop the individual attributes to measure. As earlier stated, wide scale involvement in the measurement process ensures success through understanding and acceptance. [Ref. 4: p. 137]

Through their work and study of literature on organizational performance over the past ten years, Sink and Tuttle [Ref. 4: p. 170] make the following observations:

1. There is no consensus as to performance criteria for organizational systems.
2. There are no consensus operational definitions for the commonly cited performance criteria such as effectiveness, efficiency, quality, or productivity.
3. Much of the research that looks at the impact of various improvement strategies...is difficult, at best, to translate, evaluate, and interpret because there is no consistently applied concept of what constitutes organizational systems performance.
4. ...The result has been confusion in the literature and in practice with respect to performance measurement and improvement.¹

These observations should be considered while reviewing the general performance measurement criteria proposed by Sink and Tuttle, Globerson, Brancato, and Kaplan and Norton.

1. Sink and Tuttle's Performance Criteria Categories

¹This is due to a weakness in the availability of conceptual models and operational definitions provided by academicians and practitioners in the field.

Sink and Tuttle [Ref. 4] adopt the seven performance criteria first presented by Sink [Ref. 5]. The performance criteria are effectiveness, efficiency, quality, productivity, quality of work life, innovation, and profitability/budgetability. According to the authors, this generic listing of performance criteria is complete, however criteria do overlap. They do not maintain that these are the only correct criteria. Their goal is to instill more consistency on defining organizational performance. Managers are encouraged to develop, define and implement their own criteria to fit their specific organizations.

[Ref. 4: p. 171]

Figure 1 is a diagram from Sink and Tuttle [Ref. 4: p. 137] which describes the interrelationship of the organizational system and the seven performance categories. Sink and Tuttle's rationale for the proposed seven performance criteria is briefly explained below.

a. *Effectiveness*

Effectiveness focuses on the output and outcome side. Some of the operational issues associated with effectiveness include: did we do the right things according to the specifications, did we get all the right things done, and, did we get the right things done on time. The most frequently used attributes to further define effectiveness are timeliness and quality. The authors state that the

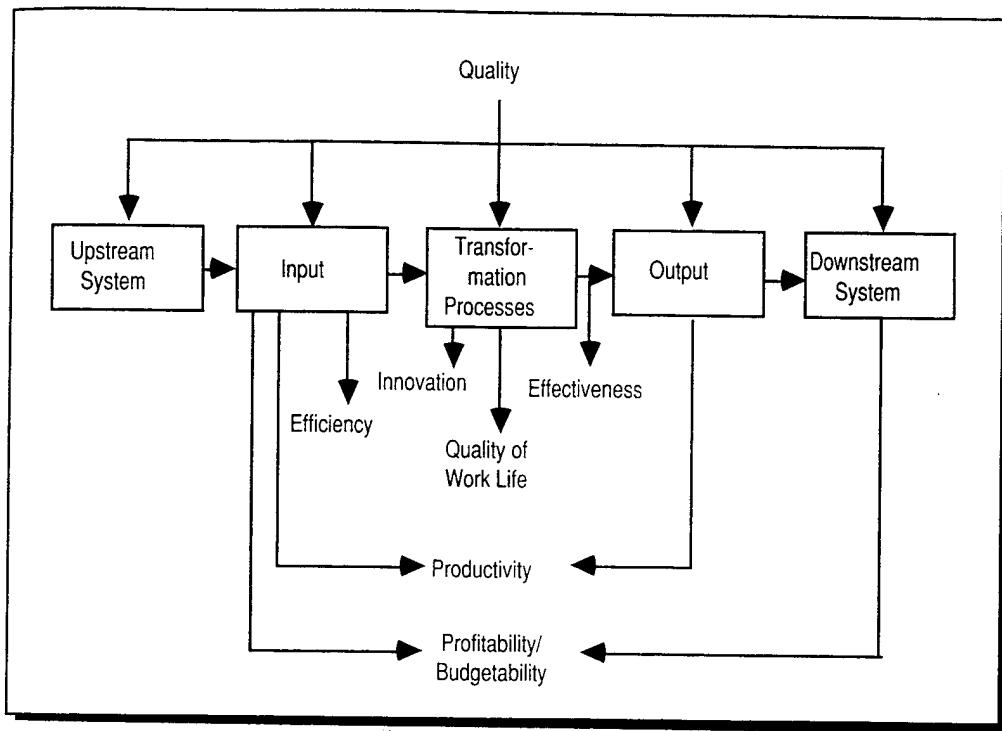


Figure 1. Interrelationship of the Organizational System and the Seven Performance Categories Proposed by Sink and Tuttle. From Ref. 4.

operational measure for effectiveness is actual output (AO) divided by expected output (EO). Effectiveness is closely tied in with the planning process. The planning process determines goals for what, when and how well to produce outputs. The effectiveness measure compares the plan and the actual output. [Ref. 4: p. 171] [Ref. 5: p. 42]

b. Efficiency

Efficiency is related to resource consumption on the input side. According to the authors, efficiency is

defined as the resources expected to be consumed (**REC**) divided by resources actually consumed (**RAC**). The authors note a relationship between efficiency and effectiveness where the REC value is linked to the EO value, and the RAC value is linked to the AO value. The REC values are measured through forecasts and budgets, while the RAC values are measured by the cost accounting systems. The authors emphasize that "an organization can be effective and not efficient, efficient and not effective, neither effective nor efficient, and still survive." [Ref. 4: p. 172]

c. Quality

Sink [Ref. 5] describes quality as "...the degree to which the system conforms to requirements, specifications, or expectations." He distinguishes quality from effectiveness by stating quality reflects the attributes or characteristics for which a product is designed and produced (such as, will the product or service do what it was designed to do?). Sink and Tuttle [Ref. 4] state that quality is critical in all stages of an organization's management process and resource flow: upstream, input, transformation process, output, and downstream. They operationally define quality by using six checkpoints, one quality checkpoint at each stage of the process and one checkpoint for the overall quality management process. [Ref. 4: p. 173]

Quality Checkpoint 1: Sink and Tuttle define this as "...the selection and management of upstream systems," such as selection of vendors and suppliers, communicating with customers concerning their needs and requirements, and working with upstream systems (vendors and suppliers) to ensure they provide what is needed to produce a quality product [Ref. 4: p. 173]. Upstream systems can be either internal or external to your organization. [Ref. 4: p. 173]

Quality Checkpoint 2: This quality assurance check ensures your organization receives what it needs and expects from the upstream system. It is very difficult to correct defects from the upstream system. Therefore, it is extremely important to ensure that the process is under control. Statistical measures are primarily used at this checkpoint. [Ref. 4: p. 173]

Quality Checkpoint 3: This checkpoint ensures that quality is built into the product or service during the transformation process. This requires measurement and evaluation processes and management support systems which promote and reward building quality into the product. [Ref. 4: p. 174]

Quality Checkpoint 4: This checkpoint ensures that the organization's output meets the customer's specifications and expectations. Quality checkpoint 4 does not replace quality checkpoint 3. Similarly, a quality control check on

the output side does not ensure that quality is built into the product or service. [Ref. 4: p. 175]

Quality Checkpoint 5: This checkpoint focuses on downstream systems. It measures "the proactive, detailed understanding of what your customers want, need, expect, and demand, as well as how they are reacting to the delivery of the goods and services you are providing." [Ref. 4: p. 177]

Quality Checkpoint 6: This checkpoint coordinates the overall quality management process. The customers play an important part in designing and developing both the input and output side of an organization. This is where quality is differentiated from effectiveness and efficiency; it is both an input and output side issue. Therefore, quality must be measured and managed at all five checkpoints. [Ref. 4: p. 172]

d. *Productivity*

Sink and Tuttle [Ref. 4: p. 180] operationally define productivity as organizational outputs divided by organizational inputs over a given period of time. Although this definition is simplistic, managers have a difficult time measuring productivity due to four operational issues:

- Organizations find it difficult to quantify the "tangibility" of outputs. Doubting the completeness of the numerator in the productivity equation, the users start to question the validity of the ratios.
- An inconsistency arises in what is defined as outputs and inputs when there is a failure to understand what

is the productivity measure unit of analysis. Taking the time to perform a thorough input/output analysis prior to developing measures can eliminate this problem.

- When measuring inputs and outputs, it is important to correlate the unit of time for which we are measuring performance. This is called defining the measurement scope.
- People tend to define productivity in the narrow sense (output over input) but, when they operationalize it, they treat it as if it were the very broad measure of performance. Productivity is only a just part of the total picture. [Ref. 4: p. 180]

e. *Quality of Work Life (QWL)*

Quality of work life (QWL) is operationally defined by Sink and Tuttle as how people feel about various aspects of their work life, such as pay and working conditions [Ref. 4: p. 182]. This performance criteria addresses the people in the organization involved in the transformation process. Many managers believe that, if people feel positively about factors they believe are important, it will positively influence their performance. This translates to a positive organizational performance.

However, Sink and Tuttle argue that research findings over the years show that there is little relationship between attitudes, feelings, and performance. They do believe that there may be a relationship between positive feelings and employee rewards from the organization. Sink and Tuttle sum up by saying that, although there is no

evidence to support a simple link between happy people and productive people, quality of life in the organization is critical to the organization's overall performance. [Ref. 4: p. 182]

f. Innovation

Sink and Tuttle operationally define innovation as "the creative process of changing what we're doing, how we are doing things, structure, technology, products, services, methods, procedures, policies, etc. to successfully respond to internal and external pressures, opportunities, challenges, threats." [Ref. 4: p. 183] The three key aspects of this definition are creativity, change, and a successful response. The authors summarize the definition of innovation as "the creative process of successfully changing whatever it takes to survive, compete, grow, and obtain whatever your desired outcomes are." [Ref. 4: p. 183]

g. Profitability/Budgetability

Profitability is used to define the bottom line for the private sector; budgetability defines the bottom line for the public sector. Both represent the relationship between an outcome in the downstream system and the input. For a profit center, the definition of profitability is "a measure or set of measures that relates revenues to costs." [Ref. 4: p. 185] For a cost center, budgetability is "a measure or set of measures of the relationship between

budgets and agreed upon goals, deliverables, and timeliness with actual costs and actual accomplishments and timeliness." [Ref. 4: p. 185]

h. Interrelationships Between the Seven Performance Criteria

In describing the interrelationships between the seven performance criteria, the authors state that management should "focus on effectiveness first: What are the right things for us to be doing?" [Ref. 4: p. 186] Next, it is important to define efficiency and quality by asking the question "What resources will we need to consume to accomplish those 'right' things and what are the quality specifications?" [Ref. 4: p. 186] Productivity will follow as long as the first three performance criteria are managed properly.

Quality of work life (QWL) and innovation act as moderators between productivity and profitability/budgetability. If managed properly QWL and innovation can enhance the organization's performance. However, poor performance in these areas can mean disaster for an organization. The authors consider profitability/budgetability to be a near-term outcome; survivability, growth, improvement, and excellence are long-term outcomes.

Because different organizations and managers are expected to weigh the seven performance criteria

differently, it is important to balance all seven performance criteria to ensure long term success. [Ref. 4: p. 186]

As stated earlier, the author's seven performance criteria define the clusters of instruments on the organization's instrument panel. They help the management team manage effectively. It's up to the organization to develop specific indicators for each individual performance criteria.

2. Globerson's Performance Criteria Categories

Globerson [Ref. 8] believes it is important to establish both vertical and horizontal criteria when developing performance criteria. A detailed breakdown follows for both vertical and horizontal criteria.

a. Vertical Criteria

Vertical criteria are used for measuring a specific unit's performance, such as the finance, personnel, or production department. Globerson proposes developing four vertical criteria: outputs, inputs, productivity and quality. [Ref. 8: p. 31]

Output criteria "are those criteria that relate to final products or services and are expressed as quantities of output per unit of time". Globerson suggests using both absolute criteria (units of output per unit of time) and

relative criteria (rate of increase in the output per unit of time). Both are necessary to tell the whole story. [Ref. 8: p. 31]

Input criteria can be defined as the input of resources per unit of time. Labor, materials, equipment and capital are usually considered resources and inputs. [Ref. 8: p. 32]

Productivity criteria reflect the units of output produced per specific input units, such as number of units per machine hour or number of finished units per employee hour. Organizations can improve productivity by either increasing the output while using the same amount of resources or by maintaining the same output using fewer resources. [Ref. 8: p. 32]

Quality criteria focus on the specific characteristics of the service or product, not the productivity or input measures. Usually, quality and productivity criteria compliment each other. [Ref. 8: p. 33]

b. Horizontal Criteria

Horizontal criteria evaluate processes which may cross departmental boundaries or may begin and end in the same department. Two types of horizontal criteria, process criteria and resource criteria, are discussed here. [Ref. 8: p. 33]

Process criteria, are frequently conducted over a varying number of departments. They are usually measured on

the basis of three different criteria: quality, cost and time. Quality can be expressed in terms of meeting given specifications or accuracy. Cost refers to the expenditures of resources, including labor, energy, equipment, building and capital. Time is measured as the period required to complete the process. [Ref. 8: p. 33]

The other horizontal criteria, resource criteria, includes efficiency and the ratio between resources and outputs. [Ref. 8: p. 35] Efficiency can be further broken down into equipment, labor, materials and operating capital.

Equipment efficiency is often called equipment utilization. It is defined as the percent of output produced by the equipment compared to the maximum output capacity per the manufacturer's specifications. However, many organizations are more interested in the inverse of this ratio, which is called "idle time."

Labor efficiency is employee output divided by the standard output (output produced by a trained employee working at a normal pace). Standard output is determined using work measurement methods. Labor efficiency can often exceed 100% as employees gain experience and learn how to improve performance over time (learning-by-doing).

For material efficiency, inventory turnover is a common criteria. Inventory turnover is the annual value of all material used by the company divided by the current value of

the material presently in the company. Material utilization compares the organization's and industry's turnover rate. The more an organization turns over its inventory, the higher the material utilization or efficiency. Operating capital is calculated by comparing the actual interest received with that of the maximum interest possible for that given financial investment. [Ref. 8: p. 36]

The ratio of resources to output, is the second resource criteria. It is used to evaluate resource performance for labor, materials, equipment and operating capital. For labor, the ratio of resources to output is calculated by dividing the labor cost by the total value of the production to obtain "required labor cost per dollar of production value." [Ref. 8: p. 38] For materials, the ratio of resources to output is found by dividing cost of materials by the value of production during a given period of time. For equipment the resources/output ratio is determined by dividing the annualized value of the equipment by the total value of annual production. The operating capital/output ratio is similarly the average monthly value of capital divided by the average monthly value of production. [Ref. 8: p. 38]

In addition to efficiency and the ratio between resources and outputs, there are special criteria for each major resource. Some of the special criteria for labor,

materials, equipment, and operating capital resources are:

- Labor: percent of employees capable of filling more than one position, employee turnover, absenteeism, training of new employees.
- Materials: percent of work in process, final products, raw materials, percent of material rejected, wasted material.
- Equipment: set up time, down time, maintenance cost per period of time.
- Operating capital: percentage of various components of operating capital. [Ref. 8: p. 38]

3. Brancato's Performance Criteria Categories

Brancato [Ref. 6] presents five measurement categories that reflect her research on a number of companies throughout the world. The five measurement criteria include: customer satisfaction, workplace practices, relationships with suppliers, environmental competitiveness and safety, and innovation. Each is briefly discussed below.

a. Customer Satisfaction

Companies realize that it is more profitable to retain an existing customer than to recruit a new one. Therefore, there is a definite financial benefit to customer satisfaction. Research shows that:

Seventy percent of the time, a very dissatisfied customer will never buy from you again. A very satisfied customer will buy from you again 85 percent of the time. In terms of what it costs to go out and get a new customer, I think the research indicates that it's about five times as

expensive to get back a customer than to keep one.
[Ref. 6: p. 23]

Customer retention is also a key profitability forecasting tool. As the length of the customer-supplier relationship increases, there is an increase in the number of purchases; there is also an increase in the "cross-cell" ratio as customers purchase other related products. It is important to measure customer satisfaction with product quality, service quality and cycle times, at a minimum. [Ref. 6: p. 23]

b. Workplace Practices

According to Brancato, most companies believe that workplace practices should interact with both the performance measurement process and the strategic vision. This type of intellectual capital can be a company's most important asset, one having hidden value. Brancato defines intellectual capital as "...the result of the linkage of human capital (training and the accumulation of knowledge, skills, and experience) with organizational processes in the company to translate that human capital into customer satisfaction, high quality output, productivity, and, ultimately, into improved financial performance." [Ref. 6: p. 27] She goes on by saying:

Some companies can be undervalued, because they possess considerable hidden values that are not accounted for in the book value...these hidden values differentiate companies and give them a

competitive edge. Therefore, grasping and systematically managing the resources that contribute to intellectual capital is essential. [Ref. 6: p. 27]

Basic workplace practices such as training, team processes, employment security, and employee satisfaction should lead to improved customer satisfaction (intermediate measures). This ultimately improves profits (final measures). [Ref. 6: p. 27]

c. Relationships With Suppliers

Closer working relations between customers and suppliers can reduce costs, improve manufacturing efficiency, reduce inventories and improve quality, ultimately benefitting both customer and supplier. [Ref. 6: p. 32]

d. Environmental Competitiveness and Safety

The pressure of complying with ever-increasing environmental regulations makes it increasingly important to measure and track environmental performance. The key to success is being proactive instead of reactive, and reduce pollutants before the production process. This reduces the "ultimate" pollution before it is discharged into the environment. Frequently it is cheaper to reduce the pollutants entering the production process than to remove the pollutants at the end of the process. This practice

increases quality, improves the environment, reduces cost and, ultimately, increases profitability. [Ref. 6: p. 32]

e. Innovation

Many companies view innovation as important in achieving competitive success. Innovation was traditionally measured by dividing the total dollars spent on research and development by the sales or profits. Each project was also evaluated using the discounted cash flow approach. However, critics point out that this method "fails to link the expenditures to viable product and profitability outputs" and to the company's strategic vision. [Ref. 6: p. 33] A recent study identifying what measures successful companies use, shows that they measure innovation, "...not from R&D dollars spent, but from the percentage of sales from new products introduced within the last specified number of years." [Ref. 6: p. 33] Instead of using the traditional discounted cash flow method, these successful companies base their investment decisions on the likely contribution to the company's strategic objectives. [Ref. 6: p. 33]

4. Kaplan and Norton's Performance Criteria Categories

Based on a year-long research project involving 12 companies at the forefront of performance measurement, Kaplan and Norton [Ref. 9 and 10] developed the "balanced scorecard." The scorecard helps managers focus on a handful

of performance criteria: the customer perspective, internal business perspective, innovation and learning perspective, and the financial perspective. Like the other authors, Kaplan and Norton suggest translating measurement criteria from the organization's mission statement. Each of the four measurement criteria presented by Kaplan and Norton are summarized below.

a. *Customer Perspective*

A customer focus has become part of the corporate mission statement for many companies. Satisfying the customer has become a top priority for management. Kaplan and Norton state that the customer's concerns fall into four categories: time, quality, performance and service, and cost.

Time, or lead time, measures the time required for the company to fulfill its customers' needs, whether it be delivering a product or service. For new products or services, lead time is the time it takes to develop a product or service from the product definition stage to the start of shipment or service provision. For existing products, lead time can be measured from the time the company receives the order to the time the service or product is delivered. [Ref. 9: p. 73]

Kaplan and Norton measure quality as the number of defects per product as perceived by the customer. Quality

can also measure the accuracy of the company's delivery claims or forecasts by measuring the on-time delivery rate. "The combination of performance and service measures how the company's products or services contribute to creating wealth for its customers." [Ref. 9: p. 73]

Cost to a customer is more than just price per unit. Customers are concerned about other supplier driven costs, such as: schedule disruptions due to incorrect deliveries; ordering costs; scrap, rework, and obsolescence and other material costs; and delivery costs. It is not uncommon for an excellent supplier to charge a higher unit price than other vendors. The high price supplier may be the overall low cost supplier if products are delivered defect-free, to the right place, at the right time, and in the right quantities. [Ref. 9: p. 74]

For the balanced scorecard to portray the customers' viewpoint, it is important for the organization to define its goals for lead time, quality, performance and service, and cost, then translate these goals into specific measures. Kaplan and Norton find that companies implementing this approach depend on the customer's evaluations to define some of the company's performance measures. Involving the customer to define lead time, quality, performance and service, and cost has helped companies realize that customers view each criteria

differently. Those companies that tailor their performance measures to their customers are the most successful. [Ref. 9: p. 73]

b. Internal Business Perspective

Superb customer service is derived from the processes, actions, and decisions made throughout an organization. Therefore, it is important that the customer-based measures previously described be translated into measures of what the company must do internally to meet its customer's demands. The internal business aspect of the balanced scorecard must focus on the internal processes which have the greatest effect on customer satisfaction. It is also important for organizations to identify their core competencies (what they do best). Core competencies, along with the critical success factors including cycle time, quality, employee skills, and productivity, must be measured to enable the company to improve over time. To improve cycle time, quality, productivity, and cost, managers must have full employee involvement in devising the measurement system. This helps ensure acceptance and understanding, and will contribute to success. [Ref. 9: p. 74]

c. Innovation and Learning Perspective

In today's global competitive business environment, businesses are required to continually improve their existing products and release new products. Customers

are always looking for new products with expanded capabilities that add more value. In order for a company to survive and grow by penetrating new markets, it is important that the company continue to release new products, improve their operating efficiencies and increase the value for their customers. In other words, a company's value is directly tied to the company's ability to innovate, improve and to learn. Many companies measure percent of sales from new products to reflect success in innovation. [Ref. 9: p. 75]

d. Financial Perspective

Critics of financial measures argue that competition has changed recently and the traditional financial measures do not improve customer satisfaction, quality, cycle time, or employee motivation. They state that a company's financial performance is a result of fundamental operational actions. As long as companies perform these fundamental operations, the financial measures will follow. They also argue that traditional financial measures are backward looking; they do not measure the organization's ability to create future value.

Kaplan and Norton, however, argue that financial measures are still valid. They state that "a well designed financial control system can actually enhance rather than inhibit an organization's total quality management program."

[Ref. 9: p. 77] More important, Kaplan and Norton argue that, an improved operating performance does not guarantee improved financial performance. An organization may improve quality or on-time delivery performance, and yet not capitalize on these operational achievements. Thus, it may fail at improving financial performance.

It is important that organizations follow up their operational improvements with another round of actions. Thus, financial performance criteria are still important. The goals of financial performance measures are to ensure the company's strategy, implementation, and execution are contributing to profitability, growth, and shareholder value. Finally it is important that companies specify how improvements made in quality, cycle time, lead times, productivity, and new products will improve the company's market share, operating margins, and asset turnover or reduce its operating expenses. [Ref. 9: p. 77]

F. SUMMARY

This literature review builds a foundation for performance measures: what they are, why they are important, the need for new measures, along with various views on measurement criteria design. There are some commonalities between all the proposals as well as some differences. What is important, however, is that no author has insisted that

their set of criteria is the only correct set. Typically, authors emphasize that each organization determine what set is appropriate for their line of business and, most importantly, get employees, customers and suppliers involved in determining the individual measurement criteria and attributes. This approach best assures that the measurement criteria are accepted and understood, enhancing the prospects for overall program success.

Most authors generally agree that the measures should be linked to the organization's goals, objectives and strategies. For maximum success, it is best to start with a clean sheet of paper. After developing proposed measures, the new list can be compared to existing measures to fill in any holes. Section B discussed some of the roles measurement can play; such as: ensuring strategy is implemented, a management support system, a control device, and for improvement. Most authors considered measurement for improvement to be the most important role. This thesis will be based on that premise.

Finally, Table 1 provides an overview of the measurement criteria categories presented by the authors discussed in this chapter. The last column lists the general measurement categories used for MSC managed Special Mission oceanographic ships in Chapter IV of this thesis.

Table 1. Summary of measurement criteria by author. General criteria listed in last column are this author's criteria set drawn from literature review.

MEASUREMENT CRITERIA BY AUTHOR				
Sink/Tuttle	Globerson	Brancato	Kaplan/Norton	This Thesis
1. Effectiveness 2. Efficiency 3. Quality 4. Productivity 5. Quality of Work Life 6. Innovation 7. Profitability / Budgetability	<u>Vertical</u> - Organizational Measurement 1. Outputs 2. Inputs 3. Productivity 4. Quality <u>Horizontal</u> - Process Measurement 1. Process Criteria (quality, cost, time) 2. Resource Criteria a. Efficiency of equipment, labor, materials & capital b. Resources to output ratio for equipment, labor, materials & capital c. Special criteria labor, materials, equipment & capital	1. Customer Satisfaction 2. Workplace Practices 3. Relationship with Suppliers 4. Environmental Competitiveness and Safety 5. Innovation	1. Customer Perspective 2. Internal Business Perspective 3. Innovation and Learning Perspective 4. Financial Perspective	1. Customer Satisfaction 2. Internal Business Perspective 3. Innovation 4. Financial Perspective

III. NAVOCEANO AND CURRENT METRICS

This chapter provides background on the Naval Oceanographic Office (NAVOCEANO), one of MSC's major Special Mission Ship sponsors. The first section will describe NAVOCEANO's mission, the ships they use and their operating characteristics. The following section describes the services MSC provides to NAVOCEANO. A list of measures that MSCPAC and MSCLANT are currently collecting or tracking is listed next. Finally, various issues which NAVOCEANO and the General Accounting Office (GAO) have with MSC's service are discussed.

A. NAVAL OCEANOGRAPHIC OFFICE

1. Background

Naval Oceanographic Office (NAVOCEANO), located at Stennis Space Center, Bay St. Louis, Mississippi, employs approximately 1,000 military and civilian personnel to support oceanographic requirements worldwide. NAVOCEANO is the largest component of its parent, COMNAVMETOCCOM (Commander, Naval Meteorology and Oceanography Command). "COMNAVMETOCCOM is tasked with executing the Navy Oceanography Program and fulfilling validated requirements, and provides, as major claimant, the necessary OM&N funds to operate and maintain the Special Mission Oceanographic Fleet." [Ref. 11] NAVOCEANO's mission is "to provide

specialized and unique oceanographic products and services to joint warfighters in a manner and timeframe that allows them to meet their objectives." [Ref. 12] The Navy's Fleet Commanders request surveys from the Defense Mapping Agency (DMA). DMA tasks NAVOCEANO, through COMNAVMETOCOM, to perform those surveys. [Ref. 13] NAVOCEANO collects hydrographic, magnetic, geodetic, chemical, navigation and acoustic data using a variety of platforms including ships, aircraft and spacecraft. In recent years, NAVOCEANO's focus has changed from deepwater survey operations to coastal or littoral regions, due to our changing defense strategy with the end of the Cold War. [Ref. 14]

NAVOCEANO performs two types of surveys: hydrographic and oceanographic.

Hydrographic surveys are conducted to measure and describe the physical features of the ocean. The information is required to ensure the safe navigation of all United States' ships outside our national territorial waters. The data is provided to the Defense Mapping Agency (DMA) for processing and printing of nautical charts. [Ref. 14]

The charts are then distributed to the Fleet Commanders. Hydrographic surveys are usually done in the territorial waters (12 NM) of another country with their permission. In which case, the United States agrees to share all the survey data with that host country and extends an invitation for one person from that country to participate in the survey. Hydrographic surveys are usually unclassified. [Ref. 13]

The second type of survey is the oceanographic survey. This encompasses the whole water column down to, and including, the bottom. Oceanographic surveys measure such things as depth of water, temperature, salinity, sound velocity, earth's magnetic field variations and gravity anomalies. They also take bottom core samples to help understand more about the shape and the texture of the ocean floor. Oceanographic surveys are rarely done in another country's territorial waters, but are usually within their Exclusive Economic Zone (EEZ), 200 NM out from shore. In this case, they are termed "Military Surveys," to legally avoid having to get permission from the host country. If U.S. ships are conducting "research," we could possibly find oil, manganese nodules or fisheries data. This information could impact the economic well-being of the host country; they would want to be fully informed. A military survey does not economically threaten a host country because the data is intended for war-fighting not economic purposes. Oceanographic surveys can either be classified or unclassified. [Ref. 13]

Surveys in recent years have shifted to littoral regions in the Western Pacific, Persian Gulf, and the Eastern Mediterranean Sea, as well as other areas that have high regional military interest. Requests from prior Eastern Bloc countries to jointly survey territorial waters

are more common in recent years. This data has been a benefit to both the Eastern Bloc country and the United States. [Ref. 13]

2. NAVOCEANO Ships Managed by MSC

NAVOCEANO currently has five ships that are in full operating status (FOS) and are conducting surveys. The older ships, originally designed to accomplish a specific mission, are continually being modified for multi-purpose operations, providing more flexibility. The new ships are designed for multi-purpose operations, including shallow water surveying in littoral areas.

The USNS SILAS BENT and USNS KANE are 30 year-old ships of the SILAS BENT class. They are approximately 285 feet in length. They perform oceanographic surveys in the EEZ, but outside the territorial waters. They are equipped with large winches for drawing bottom samples. The USNS WYMAN is a member of the SILAS BENT class, but was never equipped with large winches. It isn't capable of deep-sea coring or towing transducers. It performs oceanographic surveys outside the 12 nautical mile territorial waters and was designed primarily for deep ocean bathymetry.

The USNS LITTLEHALES and the USNS JOHN McDONNELL are approximately 4 years old and 208 feet in length. They have two sounding boats which can be deployed to perform bottom

mapping. These ships primarily conduct shallow water hydrographic surveys within territorial waters.

NAVOCEANO owns two additional ships which are in FOS, but are not currently conducting survey work. The USNS PATHFINDER and the USNS SUMNER are members of the new T-AGS 60 class of ships which are 329 feet in length and are considered true multi-purpose oceanographic ships. They are new construction and are currently undergoing acceptance trials before being assigned to active survey work in mid to late 1996. The MSC per diem charges are the same whether an FOS ship is in port or at sea.

Three ships are currently in reduced operating status (ROS). The BOWDITCH and the HENSON are members of the T-AGS 60 class; they will be delivered to the Navy in mid 1996 and 1998 respectively, and are capable of multi-purpose operations. As with the PATHFINDER and SUMNER, they are designed for deep ocean surveys, oceanographic surveys and shallow water survey operations inside territorial waters using sounding boats. They also have large deck winches to collect bottom core samples.

The third ROS ship, the USNS WATERS, has only a skeleton MSC civilian mariner crew. This 4 year old ship was formerly used by SPAWARS as a cable laying ship. It will be modified for multi-purpose survey work under NAVOCEANO. One additional ship, the T-AGS 64, which is yet

unnamed, is awaiting construction funding from Congress and is scheduled to be delivered 1 Nov 2000.

The size of the mariner crews range from 28 to 31 for the older ships; crew size is 22 for the T-AGS 60 class. In addition, each ship carries a crew of about 12 NAVOCEANO personnel, civilian and military, to perform the survey work. All the active ships in FOS status are currently contractor operated; the PATHFINDER and the SUMNER are manned by MSC civilian mariners (CIVMARS). All the ships in ROS are manned by civilian mariners. The DYNCORP contract currently allows up to six ships to be contractor operated. Additional oceanographic ships must be civilian manned or operated.

In November 1995, Admiral Boorda released a new Oceanography Policy statement. It requires a minimum of eight active oceanographic ships. [Ref. 15: p. 38-44] As the newer ships become available for active survey work, the SILAS BENT class will be retired to maintain eight oceanographic ships. [Ref. 13] [Ref. 16: p. 5]

3. NAVOCEANO'S Ship Operations

NAVOCEANO ships average 250 days at sea and 115 days in port, either at a port of call, in upkeep or in overhaul. The typical schedule is 25 days at sea and four days in port. Port calls usually involve a personnel changeout, equipment changeout and maybe a short upkeep. Unlike naval

warships, survey ships have no specific home port. They have recently been allowed to undergo their annual overhaul in foreign shipyards, which will drastically reduce the costs.

NAVOCEANO's active survey ships are manned by contract mariners from DYNCORP. They typically sign on for four to six months at a time. The NAVOCEANO survey personnel, which include civilian and military, are usually rotated every 60 days. Both the survey personnel and contract mariners are rotated in a staggered manner.

Surveys are done primarily in the Western Pacific, Persian Gulf, and the Eastern Mediterranean. Recently, some ships have been diverted to areas that are of high current military interest in order to collect survey data for use by the Department of Defense and, if in territorial waters, shared with the host country. Some former Eastern Bloc countries have requested survey work within their territorial waters. These are given high priority and require diplomatic clearances. [Ref. 13]

NAVOCEANO publishes an annual schedule for its survey ships. This schedule is updated quarterly. There is also a five year plan. This is formulated by NAVOCEANO, incorporating tasking from DMA which is communicated through COMNAVMETOCOM. Once the annual schedule has been released, few changes occur. Any major schedule changes are usually

identified at least a year in advance. Changes in the quarterly updates are usually minor, primarily affecting port calls.

Schedules also consider the diplomatic clearance processing time required for surveying in foreign territorial waters. These usually require a long lead time. As a condition for obtaining a clearance, the U.S. agrees to share the survey data with the host country and typically invites one or two hydrographers or oceanographers to assist NAVOCEANO in collecting the survey data. Clearances are only good for a certain window of time. Therefore, it is important to accurately schedule those operations.

Equipment change outs are accomplished within 5 days in the nearest port. They don't require a shipyard. The ships call on the nearest port which can provide the services, with an emphasis on minimizing the time and distance to a port and port call time to get the ship back out on station as quickly as possible. The contractor will send representatives or agents to those ports of call to arrange for required services. [Ref. 13]

Ships may revert to an ROS status during overhauls or occasionally when a C-4 CASREP (serious equipment malfunction which prevents the ship from accomplishing its mission) prevents them from getting underway for a period greater than one month. During ROS, the ship's

watchstanders are reduced to the minimum required number.

That reduces the per diem rate. [Ref. 13]

B. WHAT MSC PROVIDES FOR NAVOCEANO

A memorandum of agreement (MOA) between the Commander, Military Sealift Command (COMSC) and the Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCOM) lays out the responsibilities of each party in managing the oceanographic ships. COMSC is typically responsible for support, administrative control and operational control of the ships. COMSC delegates these responsibilities to the appropriate COMSC area commanders. COMNAVMETOCOM has technical control of the ships and provides funding support for the ship's operation and maintenance. COMNAVMETOCOM delegates ship technical control to the Naval Oceanographic Office (NAVOCEANO). [Ref. 17: p. 2]

The following is a list of some of the services that MSC provides NAVOCEANO:

- Operational oversight, including scheduling and activation/deactivation planning, through MSC Area Commanders
- Maintenance and repair including configuration control and integrated logistics support
- Contract management and quality assurance of contract operators
- Finance and accounting services including budget/POM submittals and invoice certification and payment

- Maintenance of insurance reserves for accidents and claims
- Expertise in admiralty law, contract law, maritime contract law, maritime insurance law, environmental law and engineering repair
- Independent compliance checks for US Coast Guard (USCG) /American Bureau of Shipping (ABS) certification
- Maintenance of ISO 9000 quality standards
- Compliance with Navy mandated pollution control requirements such as oil pollution and spill response, HAZMAT control, plastics at sea, ozone depleting substances, and NAVOSH
- Personnel and training management. [Ref. 18] [Ref. 19]

C. MEASURES CURRENTLY TRACKED BY MSC

The research methodology includes comparing proposed MSC performance measures developed independently in Chapter IV with those currently being tracked by MSCPAC and MSCLANT Special Missions personnel. This comparison will reveal various holes and overlap between the two lists.

The following is a list of performance measures provided by MSCPAC. These are generic and not specific to the Special Mission Ship program because MSCPAC currently does not manage any oceanographic ships.

- Status Of Resources and Training System (SORTS) data
- Equipment Casualty Reporting (CASREP) system data
- Number of days mariner waits in the pool
- Training pipeline costs

- Work progress of ships in maintenance availability
- Daily ship performance through operational reports (MOVREPS) and daily summaries
- Number of days/yr ship is available to perform mission
- Cost per available day
- Billing data [Ref. 20]

MSCLANT (Special Mission Ships East) provided a more comprehensive list of measures broken down by contract operated ships and civil service manned ships. The more detailed list reflects that MSCLANT is the Contracting Officer Technical Representative (COR) for the DYNCORP oceanographic ship contract. The following measures are tracked. Some are controllable and are actually managed while some are just indicators for monitoring:

CONTRACT OPERATED SHIPS

- Actual survey time versus sponsor requested operations
- External audits
- Control discrepancy report tracking
- Contractor Invoice Review and Certification
- Overall maintenance and repair oversight
- Port engineer attendance at overhauls
- Review of specification packages
- Administrative contracting officer approval of work and costs
- Validated user complaints from sponsor

- On-hire/off-hire management
- ROS/FOS/RAV status control (Reduced Operational Status, Full Operational Status, and Repair Availability)
- SORTS, CASREPS, Movement Report (MOVREP)
- Weekly Operational Summary Reports (WOSR) or Regular Overhaul reports (ROH) [Ref. 21]

CIVIL SERVICE MANNED SHIPS

- Actual survey time versus sponsor time requested
- CIVMAR performance/assignments
- SORTS reporting
- CASREP reporting
- MOVREP reporting
- WOSR/ROH reports
- ROS/FOS management
- Per diem structure
- Customer satisfaction
- Training/pipeline costs [Ref. 21]

The Special Mission Ships Program Manager was unable to provide a list of measures tracked by COMSC. However, measures are a high priority. Within the next six months, COMSC will be developing their own measures in conjunction with their reinvention efforts.

D. ISSUES NAVOCEANO AND GAO HAVE WITH MSC SERVICE

Various issues surfaced when interviewing Operations and Financial directorate personnel at NAVOCEANO and COMNAVMETOCOM between 29 JAN 96 and 1 FEB 96. Additional issues were identified in the newly released General Accounting Office (GAO) report entitled *Military Sealift Command: Weak Controls and Management of Contractor-Operated Ships*. The following discussion of issues is not meant to be an all inclusive list but represents some key concerns of MSC's customers at one point in time. These concerns were used in constructing performance measures for MSC's Special Mission Ships.

Each issue will be discussed briefly below. This list is not in any specific order of priority or importance. The discussion will not recommend particular solutions to each issue. Instead, the following chapter will propose measures with which MSC can gauge its improvement in serving its customers.

1. NAVOCEANO Issues

a. *Maintenance of Mission Related Deck Equipment (MRDE)*

Properly operating and maintaining all mission related deck equipment (MRDE) is critical for completing the oceanographic ship's mission. MRDE is so important to

NAVOCEANO, that its proper maintenance is spelled out both in the MOA between COMSC and COMNAVMETOCOM [Ref. 17: p. 7] and the contract between COMSC and DYNCORP [Ref. 22: p. 73-74].

For example, when MSC and NAVOCEANO drew up the contract statement of work (SOW) requirements, they stipulated that the contractor must provide one Port Engineer who should have the ability "demonstrated through training and experience, to manage the maintenance, troubleshooting and repair of mission related deck machinery, hydraulic systems and related electrical systems." [Ref. 22: p. 19] The contractor must also provide a monthly mission related deck equipment status report, summarizing the condition of all the mission related deck equipment [Ref. 22: p. 74].

During its annual ship check, NAVOCEANO is discovering signs of neglect in both maintaining MRDE and reporting its condition despite the emphasis they receive both in the MOA and in the contract. Specifically, some of the shortcomings identified in January 1996 were dry, unlubricated gears inside gear boxes; winches that could not be tested because the fairlead blocks had frozen; winches that had been out of service for several months despite a monthly status report submitted just five days earlier stating all equipment was 100% ready (the NAVOCEANO Sponsor

Designated Representative (SDR) concurred with that report). It is not known whether these discrepancies have yet impacted the ship's mission. [Ref. 23]

b. Ship Configuration Management

The MOA states "MSC shall have direct responsibility for authority over material condition for areas assigned in Appendices II and III." [Ref. 17: p. 9] The shipboard automated maintenance management (SAMM) system "was developed to provide an accurate and efficient means to schedule, document, track, report, and manage shipboard maintenance. The SAMM system also maintains accurate machinery history and equipment configuration." [Ref. 22: p. 297] SAMM includes a data base of all the ship's equipment broken down by components with narratives describing the proper maintenance for these components. This system is similar to the active Navy's Material Maintenance Management (3M) system. However, advocates say SAMM is much easier to manage.

MSC, through it's contractor DYNCORP, is responsible for updating SAMM each time there is an equipment deletion or addition. Updates to the ship's configuration file are submitted by the contractor through COMSC. MSCLANT and COMSC Engineering personnel review those configuration changes and forward them to Seaworthy, the contractor who designed and implemented the SAMM system.

Seaworthy, in turn, mails out ship configuration file updates via disk to all the ships.

NAVOCEANO's annual ship checks reveal that additions and deletions to the MRDE are not updated in the ship's configuration file. Specifically, the ship checks in January 1996 of the KANE, WYMAN and LITTLEHALES revealed that some of the MRDE equipment and many of the components are not listed. Some of the maintenance action narratives match the equipment in name only and the configuration files do match the name tag data on the equipment.

The result is incomplete files of equipment actually on the ship, missing or improper preventive maintenance (PM) and corrective maintenance (CM) narratives for the components, inadequate tech manual support, and inadequate Coordinated Shipboard Allowance List (COSAL) support for the equipment. This ultimately leads to inadequate repair part support and degraded material readiness. [Ref. 23]

c. MSC Overhead Costs

NAVOCEANO, along with other Special Missions Program sponsors, are very concerned about the overhead costs paid to MSC for managing their ships. They suspect that MSC's overhead costs are excessive (as evidenced by their desire to obtain cost estimates from outside ship management firms) [Ref. 11]. They believe they're paying

more than their fair share for what they receive back in services. MSC hopes that reinventing and adopting a Program Manager organization structure will greatly reduce its overhead costs. (To date, COMSC has not released any estimates of its expected savings from changing to a program management structure.) Unless MSC can impress ship sponsors by improving service, sponsors will continue to look for alternatives. [Ref. 11]

d. MSC's Management of Sponsor Funds

In this era of declining military budgets, it is important that MSC be accountable and responsible for the sponsors' funds which pay them. In March and April 1995, MSC returned several balances to COMNAVMETOCCOM from prior year work orders. These funds were returned too late to be used for any other purpose. COMNAVMETOCCOM received \$1,367,762 of fiscal Year 1991 through 1993 money, which was recaptured from charter and hire costs, overhaul and installations, and sponsor reimbursables. MSC still holds \$831,430 in contingency for legal settlements. It should be noted that MSC has since been working with NAVOCEANO and COMNAVMETOCCOM to return the balances in a more timely manner (i.e., at the end of overhaul, upon cancellation of services or before the end of each fiscal quarter). [Ref. 24]

e. Overstated Cost Estimates

Related to the slow return of the sponsors' money, there is also a problem with COMSC's initial cost estimates for such items as overhaul, installation costs and sponsor reimbursables. Of the expired funds available for recapture, 45.9% to 83.3% of the original authorized amount was returned to the Sponsor. The percentage still held in contingency for legal settlement ranged from 37.1% to 53.7%. This suggests that MSC has taken an ultra-conservative position in holding COMNAVMETOCOM's and NAVOCEANO's limited funds for contingencies. [Ref. 24]

f. Ship Sighting Report

The contract requires the contractor to submit a Ship Sighting Report via Naval Message each time the ship spots a foreign ship or plane (within reason). [Ref. 22: p. 251] NAVOCEANO is receiving pressure by the Office of Naval Intelligence (ONI) in Suitland, Maryland for not submitting any reports. Due to their unique operating areas, some of these ships are known to be sighting non-friendly foreign contacts. However, no reports are being transmitted. This will become an increasingly important issue, now and into the future, as NAVOCEANO performs surveys inside the territorial waters of previous Eastern Bloc countries and other areas of military interest. [Ref. 25]

g. Logistics

The MOA delineates logistics responsibility as follows:

Upon request, MSC shall provide or arrange for receipt, temporary storage, packing, crating, and shipment of Sponsor's material at remote ports.

The sponsor shall provide sufficient advance notice of such operations to enable the COMSC Area Commander to provide additional support through normal procurement action. [Ref. 17: p. 8]

An important problem area for NAVOCEANO is world wide mail delivery to the ships. Personnel rely on the mail service for personal mail, spare parts, high priority requisitions, official correspondence and charts. At times, the mail may not get delivered due to Air Mobility Command delays or logistics problems. These are usually beyond the contractor's capability to resolve. Therefore, it is important for the MSC field offices to work with the Sponsor (SDR) to resolve the logistics issue and minimize the effects on the ship's mission. [Ref. 11]

h. Quality of Life

Food quality and service is a quality of life issue that NAVOCEANO considers important. This is a critical morale factor that affects both NAVOCEANO's survey crew and the contractor's crew. [Ref. 11]

2. GAO Audit Results

Mr. Jim McDiarmid, MSC's new Program Manager for the Special Missions Program, recommended the recently completed GAO audit, entitled *Military Sealift Command: Weak Controls and Management of Contractor-Operated Ships*. He particularly suggested considering the report's discrepancies and recommendations for identifying performance measures. [Ref. 26] The following discrepancies were among those identified:

- Inadequate documentation and review of crew-performed repairs resulting in overpayments
- Insufficient invoice documentation to ensure that subcontractor's prices are fair and reasonable
- Inconsistent requirements for documentation supporting invoices
- MSC field staff generally not involved in the invoice review process
- No controls to prevent contractors from circumventing requirements to receive MSC's prior approval for subcontracts
- No consistent verification that overhaul work is complete and prices are reasonable
- No standard procedures to develop personnel requirements including: crew qualification, citizenship, security clearance and trustworthiness evaluations
- No systematic approach to identify and implement best practices
- Fragmented lines of authority impeding sound management controls [Ref. 27]

Correcting the above items can improve MSC's customer

service, especially for NAVOCEANO. Unfortunately, a measurement system alone won't correct these problems. Their resolution generally requires process innovations. This topic is beyond the scope of this thesis. Performance measures will simply quantify the improvement in MSC's performance.

The trustworthiness evaluation is important to NAVOCEANO's sensitive mission. It determines the loyalty of an individual by conducting "national agency checks of Federal Bureau of Investigation and other agency records to divulge negative information such as drug and alcohol abuse and felony convictions." [Ref. 27: p. 35] GAO found that the trustworthiness evaluations were being processed too slowly. Of those processed, more than 10% of the contractor crews were found to be untrustworthy and were subsequently removed from the ships. Of the four oceanographic ship crew lists which GAO checked in January 1995, MSC only completed 39 of the 94 trustworthy evaluations. [Ref. 27: p. 38]

E. SUMMARY

The purpose of this chapter was to discuss NAVOCEANO, its mission and some background on the ships that MSC manages. This chapter also described what MSC provides in terms of ship management for NAVOCEANO, referencing the MOA and the contract. The performance measures currently being

collected and tracked by MSCPAC and MSCLANT were presented, followed by some of the shortcomings in MSC's service identified by NAVOCEANO and GAO. The next chapter will propose a broad set of measurement categories, along with individual metrics, which will allow MSC to monitor ongoing improvements in the Special Mission Oceanographic Ships program.

IV. PROPOSED MEASURES

This chapter proposes a set of measures to track improvements in MSC's management of the Special Mission Oceanographic Ships. The top level measurement categories will be based on the general categories synthesized from the literature review and summarized in Table 1 of Chapter II. Drawing on interviews with Naval Oceanographic Office (NAVOCEANO) personnel, the Memorandum Of Agreement (MOA), MSC's contract with DYNCORP, MSC's Mission and Vision statement, and the author's personal knowledge and experience with U.S. Naval ship operations, some lower level measures will be presented which could apply specifically to the MSC's management of oceanographic ships. A short discussion will follow on how these measures can help solve some of the current issues NAVOCEANO and GAO have identified with regard to MSC's ship management.

There is no single correct way for structuring the top level and lower level measurement hierarchy. This is just a proposed framework. The final decision should be made by those involved in the process, including MSC personnel, customers, suppliers, etc. All participants should work together to identify and develop measures for improvement.

A. MEASURES APPLICABLE TO OCEANOGRAPHIC SHIP MANAGEMENT

Four top level measurement categories have been formulated for oceanographic ship management, based on the general measurement categories synthesized from the literature review. These measures are summarized in Table 1 of Chapter II. They include: customer satisfaction, internal business perspective, innovation, and financial perspective. For simplicity in presenting this material, definitions for these measures are provided in the Appendix.

1. Customer Satisfaction

Customer satisfaction measures focus on the things which are most important to NAVOCEANO in fulfilling its mission. This category aggregates four sub categories: ship performance, customer service, contract compliance, and human resources.

a. Ship Performance

Ship performance measures whether the ships are available when required, where required, in a high state of material readiness and at low cost. The ships are required to meet a high operating tempo with no maintenance problems.

Ship performance is measured by:

- **Ship Availability:** Ship availability is directly measured by the number of survey days versus the number of survey days requested by sponsor. Some indirect measures to provide a wider scope of ship

operations are percent of time in meeting ship schedule goals; work progress of ships in maintenance availability, overhaul and equipment changeouts; and data provided from SORTS, MOVREPs, Weekly Operations Summaries and Daily Position Reports.

- Maintenance/Repair: maintenance/repair is indirectly measured by data derived from SORTS; CASREPs; work progress of ship in availability; equipment changeout and overhaul; operating test results; inspection results; product quality (sponsor evaluation of material condition); and audit results of ship configuration, SAMM system, MRDE maintenance and propulsion plant maintenance.
- Exercise Performance: This is indirectly measured by how the ship and crew respond to various exercises and drills.
- Inspection Results: These are indirectly measured by an aggregate of administration, supply and security inspection results.
- Product Quality: A subjective measure derived from a sponsor directed survey which asks for customer evaluations of the four previous areas.

b. Customer Service

Customer service pertains to those remaining services that MSC provides directly to NAVOCEANO, or through the contractor to NAVOCEANO, to support daily ship operations. These are no less important than ship performance; success or failure in these areas will determine whether one maintains or loses a customer.

Customer service is measured by:

- Fiscal Responsibility: This is directly measured by time to return unused Sponsor Funds; percentage of cost estimates returned to sponsor; ship cost per available day and overhead cost per ship. An indirect measure can be invoice audit results.

- **Flexibility/Responsiveness:** This is directly measured by the time to respond to sponsor requests. Some indirect measures are customer satisfaction; survey results and validated user complaints from the sponsor.
- **Logistics:** Logistics is directly measured by the amount of time to move people, equipment, mail, etc., to and from the ship. This can be indirectly measured by customer survey results.
- **Port Services:** This can be indirectly measured by the amount of time required to meet customer requests and by customer satisfaction survey results.

c. Contract Compliance

Contract compliance monitors key areas to ensure the contractors fulfill all their responsibilities as set forth in the contract. These actions or inactions, directly or indirectly, have some impact on the Sponsor. Measures having to do with maintenance are described under Maintenance/Repair.

Contract compliance is measured by:

- **Submission of Required Reports:** An indirect measure based on audit results of whether all the reports are submitted as required and properly completed. Specific reports of current interest to NAVOCEANO, such as the Ship Sighting Report, Mission Related Deck Equipment Status Report, SAMM Monthly Report, and the Configuration Change Report should be tracked more closely until the problems are resolved.
- **Security Audit Results:** This is an indirect measure to ensure the contractor has met all of the security requirements he claims he had.
- **Contract Audit Results:** This is directly measured by collecting contract audit results, including the correction of previous discrepancies.

d. Human Resources

Human Resources involves managing the contractor's mariners and MSC's civilian mariners who operate the oceanographic ships. It encompasses quality of life, career development, training and qualification requirements, and trustworthiness evaluations. All of these items affect NAVOCEANO's customer satisfaction. Finally, this category includes quality of life issues which not only affects both categories of mariners but also NAVOCEANO's survey crew.

Human Resources is measured by:

- Quality of life: This is indirectly measured by quality of life surveys distributed to mariners and sponsor crew members.
- Training: Training is indirectly measured by audit results of training and qualification records. Another indirect measure is the civilian mariner (CIVMAR) training pipeline cost.
- Career Development: Career development is indirectly measured by CIVMAR performance/assignments and the number of days the mariner waits in the pool until assignment to a ship.
- Trustworthiness Evaluation: This is directly measured by the percent of crew with completed trustworthiness evaluations and number of days to process a trustworthiness evaluation after receipt by MSC.

2. Internal Business Perspectives

The internal business perspective measures MSC's internal operations that support its customer's requirements. MSC's internal measures should concentrate on

those processes which have the greatest impact on customer satisfaction.

The internal business perspective is measured by:

- Processes: This is indirectly measured by such things as process cycle times; percent of MSC field staff time spent on invoice certification; percent of overhaul jobs verified by MSC field staff; time to review specification packages; percent invoices audited; MSC attendance at overhauls; overhead cost per ship; and process audit results.
- Communication: This is indirectly measured by internal survey results.
- Accountability, Responsibility and Authority: This is indirectly measured by survey results from MSC managers.
- Workplace Practices: This is indirectly measured by internal survey results and employee turnover rate.

3. Innovation

Innovation measures MSC's ability to maintain and also improve its competitiveness. MSC's ability to innovate and continually improve its processes will determine whether the Special Mission Ship Sponsors will continue to look at other ship management alternatives, or whether they will remain a customer. In essence, without the protection of Public Law mandating MSC as the prime ship manager, innovation is the key to MSC's survival.

Innovation is measured by:

- Cost: Cost is directly measured by percent reduction in total cost; percent reduction in ship cost per available day; and percent reduction in process cycle time and cost.

- Customer loyalty: This is indirectly measured by customer satisfaction survey results; percent of budget funded by new business; percent of existing business retained; and by the number of RFI's and RFP's for ship services released by sponsors per year.

4. Financial Perspective

The financial perspective focuses on MSC's financial resources. These measures indicate how MSC's strategy affects its total budget and the Sponsor's.

Financial perspective is measured by:

- Budget: This is directly measured by such things as time to return unused sponsor funds; percentage of estimated cost returned to sponsor; ship cost per available day; overhead cost per ship; actual maintenance availability costs versus budgets; and monthly cost of ship operation versus budget.
- Contract compliance: This is indirectly measured by invoice audit results and percentage of total invoices in error.

B. PROPOSED MEASURES AND COMPARISON TO CURRENT MSC MEASURES

The measurement structure for oceanographic ship management discussed above is summarized in Tables 2 through 5. Those measures in bold are the things MSCLANT and MSCPAC are not currently tracking. It is evident, when reviewing these, that there are some proposed measures which overlap with what MSC is currently tracking. There are also many proposed measures which MSC is not tracking. A discussion of this comparison appears in Chapter V.

Table 2. Customer Satisfaction Measurement Criteria. Measures highlighted in bold are not currently tracked by MSC.

<u>CUSTOMER SATISFACTION</u>	
Ship Performance	
Ship Availability	
<ul style="list-style-type: none"> ● # actual survey days versus. # days requested ● % of time meeting schedule goals ● Work progress of ship in availability, equipment changeout & overhaul ● MOVREPS ● WOSR ● Daily Position Report 	
Maintenance/Repair	
<ul style="list-style-type: none"> ● SORTS ● CASREPs ● Work progress of ship in availability, equipment changeout & overhaul ● Operating test results ● Inspection results ● Product quality (Sponsor evaluation of material condition) ● Audit results (MRDE maintenance, ship configuration, SAMM system, propulsion plant maintenance) 	
Exercise Performance (ship & crew response to drills and exercises)	
Inspection Results (an aggregate of admin, supply and security inspection results)	
Product Quality (Sponsor evaluation of four categories concerning ship performance)	
Customer Service	
Fiscal Responsibility	
<ul style="list-style-type: none"> ● Time to return unused Sponsor funds ● % of estimated cost returned to Sponsor ● Ship cost per available day ● Overhead cost per ship ● Invoice audit results 	
Flexibility/Responsiveness	
<ul style="list-style-type: none"> ● Time to respond to Sponsor request ● Customer satisfaction survey results ● Validated user complaints from sponsor 	
Logistics	
<ul style="list-style-type: none"> ● Time to move people/equipment/mail to and from ship ● Customer satisfaction survey results 	
Port Services	
<ul style="list-style-type: none"> ● Time to respond to Sponsor request ● Customer satisfaction survey results 	
Contract Compliance	
Submission of Required Reports	
<ul style="list-style-type: none"> ● Required report audit results ● Report tracking 	
Security Audit Results	
Contract Audit Results	
Human Resources	
Quality of Life (mariner and Sponsor crew surveys)	
Training	
<ul style="list-style-type: none"> ● Training and qualification records audit results (CIVMAR and contractor mariners) ● CIVMAR training pipeline costs 	
Career Development	
<ul style="list-style-type: none"> ● CIVMAR performance / assignments ● # days CIVMAR waits in pool until ship assignment 	
Trustworthiness Evaluation	
<ul style="list-style-type: none"> ● % of crew with completed trustworthiness evaluations ● # days to process trustworthiness evaluation after receipt from contractor 	

Table 3. Internal Business Perspective Measurement Criteria. Measures highlighted in bold are not currently tracked by MSC.

<u>INTERNAL BUSINESS PERSPECTIVE</u>	
Processes	
●	Process cycle times
●	% of MSC field staff time spent on invoice certification
●	% of overhaul jobs verified by MSC field staff
●	Time to review specification packages
●	% invoices audited
●	MSC attendance at overhauls
●	Overhead cost per ship
●	Process audit results
Communication	
●	MSC internal survey results
Accountability, Responsibility and Authority	
●	MSC leadership survey results
Workplace Practices	
●	MSC internal survey results
●	Employee turnover rate

Table 4. Innovation Measurement Criteria. Measures highlighted in bold are not currently tracked by MSC.

<u>INNOVATION</u>	
Cost	
●	% reduction of total cost
●	% reduction of ship cost per available day
●	% reduction in process cycle time
●	% reduction in process cost
Customer Loyalty	
●	Customer satisfaction survey results
●	% of budget funded by new business
●	% of existing business retained
●	# of RFIs and RFPs for ship services released by Sponsors per year

Table 5. Financial Perspective Measurement Criteria. Measures highlighted in bold are not currently tracked by MSC.

FINANCIAL PERSPECTIVE	
Budget	<ul style="list-style-type: none">● Time to return unused Sponsor funds● % of estimated cost returned to Sponsor● Ship cost per available day● Overhead cost per ship● Actual maintenance availability / overhaul costs versus budgeted● Monthly cost of ship operation versus budgeted
Contract Compliance	<ul style="list-style-type: none">● Invoice audit results● % of total invoices in error

C. NAVOCEANO AND GAO ISSUES

This section lists the issues that NAVOCEANO and GAO have with MSC's ship management service as previously described in Section D of Chapter III. Following each issue, measures are presented that would identify the problem and track progress towards solving it.

1. NAVOCEANO Issues

Problem: Neglected maintenance of mission related deck equipment (MRDE) .

Measures:

- MRDE maintenance audit results
- Product quality survey (sponsor evaluation of material condition)
- Product quality survey (sponsor evaluation of total ship performance)
- Submission of required report (MRDE Status Report)

Problem: Ship configuration in SAMM system is incomplete and inaccurate.

Measures:

- Ship configuration audit results
- SAMM system audit results
- Submission of required reports (SAMM Monthly Report)
- MSC attendance at overhauls

Problem: MSC overhead costs excessive.

Measures:

- Ship cost per available day
- Overhead cost per ship
- Number of outside RFQ's and RFI's requested by sponsors per year
- Customer service survey results

Problem: Slow return of unused sponsor's funds.

Measures:

- Time to return unused sponsor funds
- Customer satisfaction survey results

Problem: Overstated cost estimates.

Measures:

- Percentage estimated cost returned to sponsor
- Customer satisfaction survey results

Problem: Insufficient Ship Sighting Reports sent.

Measures:

- Submission of required reports (Ship Sighting Report)

- Contract audit results
- Customer satisfaction survey results

Problem: Logistics problems

Measures:

- Time to move people/equipment/mail to ship
- Customer satisfaction survey results

Problem: Quality of Life (inadequate food quality and service)

Measures:

- Mariner/sponsor quality of life survey results
- Customer satisfaction survey results

2. GAO Audit Discrepancies

Problem: Inadequate documentation and review of invoices resulted in overpayments and questionable pricing.

Measures:

- Percent of total invoices audited

Problem: MSC field staff not reviewing invoices.

Measures:

- Percent of field staff time spent on certification

Problem: No controls preventing contractors from circumventing requirements.

Measures:

- Percent field staff time spent on certification

Problem: No verification that overhaul work is complete and reasonably priced.

Measures:

- Number of overhaul jobs verified by MSC field staff

Problem: No standard procedures to develop personnel requirements.

Measures:

- Percent of crew with completed personnel check
- Number of days to process requirements

Problem: Trustworthiness evaluations processed too slowly.

Measures:

- Percent of crew with completed trustworthiness evaluation
- Time to process trustworthiness evaluation after receipt from contractor

Problem: No systematic approach to identify and implement best practices.

Comment: To the extent it can be done, measurements in general address this issue.

Problem: Fragmented lines of authority.

Comment: Measurements are showing where there are problems and will identify the fragmented line of control if that is the problem's cause.

D. SUMMARY

The purpose of this chapter was to propose a broad set of measurement categories, along with individual metrics which will allow MSC to monitor ongoing improvements in the

Special Mission Oceanographic Ship Program. These measures were summarized in Tables 2 through 5. Those measures not tracked by MSC at the time of this research were also highlighted in the tables. Finally, this chapter listed the issues of concern to NAVOCEANO and GAO with regard to MSC's ship management, along with measures that would identify the problem and track progress towards solving it.

As discussed earlier in this chapter, there is no single correct way for structuring and defining the hierarchy of measures. This is only a proposed framework and not necessarily a complete set of measures. Identifying and developing the final measures for improvement must be completed by MSC and other cognizant personnel who participate in the process. Their involvement ensures maximum success through acceptance and understanding of the measures.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

This thesis set out to develop a set of measurement criteria to monitor the improvements made in MSC's Special Mission Oceanographic Ship program. Specifically, the goal of this thesis was to answer the following research questions:

Primary:

What appropriate measures of performance can MSC use to monitor ongoing improvements in the Special Mission Oceanographic Ship program?

Subsidiary:

What aspects of service are important to MSC's oceanographic ship customers?

What aspects of service does MSC perceive to be important to its customers?

This research revealed four broad measurement criteria that could adequately cover the mission of the MSC Special Mission Oceanographic Ships. These four include: customer satisfaction, internal business perspective, innovation and financial perspective. They were derived from the overview of measurement criteria, presented in Chapter II. Customer satisfaction measures those things which are most important to NAVOCEANO in fulfilling its mission. The internal

business perspective measures MSC's internal operations that support its customer's requirements. Innovation measures MSC's ability to maintain and improve its competitiveness, and ensure its survival into the future. The financial perspective measures how MSC's implementation of its strategy affects its bottom line and that of the customer.

The research suggests that the aspects of service which MSC considers important do not match its customers' view. Tables 2 through 5 reveal areas of overlap in the measures relating to ship availability and the management of CIVMARS. Unfortunately, NAVOCEANO's concerns extend beyond meeting operational and major maintenance schedules. Research and interviews revealed NAVOCEANO is also concerned about managing scarce funds, overhead costs and cost estimates, maintaining Mission Related Deck Equipment, logistics, security, and quality of life. These gaps in MSC's measurement system appear in Tables 2 through 5 as bold print.

MSC must understand the mission and needs of its customers, as well as how they define quality. A supplier and customer may define quality differently. This is why it is important to involve the MSC personnel, customers and suppliers in the measurement development process to ensure understanding and acceptance of the measures.

B. CONCLUSIONS

This thesis research suggests the following conclusions:

There are some elements of performance the customer considers important that MSC is not tracking. These shortfalls in service were brought to light by interviewing some MSC customers, COMNAVMETOCOM and NAVOCEANO. They are discussed in Chapter III. In these years of tighter fiscal budgets it is increasingly important for MSC to create value by understanding their customers' needs and in filling those needs. MSC's reinvention process and implementation of a program manager structure is a step in the right direction.

It is important to get MSC personnel, their customers and suppliers, etc. involved in identifying and developing measures for improvement monitoring. In addition to understanding what quality means to both MSC and its customers, involvement by all cognizant personnel will enhance acceptance and understanding, provide a more relevant set of performance measures, and maximize performance results. Once the measures are developed, they should be weighted (priority ranking) based on what is most important to both MSC and the customer. Using these weights and a uniform scoring system, individual measures can be

aggregated to reflect the Special Mission Ship's overall program performance.

Measures identify problems and quantify the improvement made in performance. A measurement system alone won't correct problems. Problem resolution generally requires process innovations and a business strategy which is linked to the measures.

C. RECOMMENDATIONS

The following recommendations are provided:

- This measurement process needs to be validated by the MSC customer. This ensures understanding of how the customer perceives quality.
- Establish weights to aggregate measures (priority rankings). MSC will gain an understanding of what is most important to the customer.
- Expand this measurement process to all MSC Special Mission Ship operations. The four broad level criteria, and most of the lower level measures are general enough for all Special Mission Program ships. The specific measures can be easily modified to fit the specific equipment or situations applicable to each sponsor's mission.

LIST OF REFERENCES

1. Military Sealift Command, *Military Sealift Command 1994 In Review*, 1995.
2. Military Sealift Command, *Reinvention Implementation Feb '96*, 1996.
3. Military Sealift Command, *MSC Backgrounder*, 1992.
4. Sink, D.S., and Tuttle, T., *Planning and Measurement in Your Organization of the Future*, Industrial Engineering and Management Press, 1989.
5. Sink, D.S., *Productivity Management: Planning, Measurement and Evaluation, Control and Improvement*, John Wiley & Sons, 1985.
6. Brancato, C.K., *New Corporate Performance Measures*, The Conference Board, 1995.
7. Henderson Jr., L.J., "GPRA: Mission, Metrics, Meaning, and Marketing," *The Public Manager*, Vol. 24, No. 1, Spring 1995.
8. Globerson, A., Globerson, S., and Frampton, J., *You Can't Manage What You Don't Measure*, Avebury, 1991.
9. Kaplan, R.S., and Norton, D.P., "The Balanced Scorecard—Measures That Drive Performance," *Harvard Business Review*, January-February 1992.
10. Kaplan, R.S., and Norton, D.P., "Putting the Balanced Scorecard to Work," *Harvard Business Review*, September-October 1993.
11. Commander, Naval Meteorology and Oceanography Command Memorandum to Commander, Military Sealift Command, Subj: Operating Contracts Working Group Survey, 25 September 1995.
12. Naval Oceanographic Office (NAVOCEANO) Homepage, <http://www.navo.navy.mil/navo/navohom.htm> updated 9 March 1996.
13. Interviews between D. Smith, Commander, USN, N35, G. Madden, N3512, Naval Oceanographic Office and author, January - March 1996.

14. Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCOM) Homepage, <http://www.cnmoc.navy.mil/> updated 27 November 1995.
15. Davis, G.W. IV, RADM, "A New Naval Oceanographic Policy," *Sea Technology*, January 1996.
16. Military Sealift Command Slide, Subj: Special Mission Ship Working Group Final Report, 26 July 1995.
17. Commander, Military Sealift Command Memorandum to Commander, Naval Meteorology and Oceanography Command, Subj: MOA Between COMSC and COMNAVMETOCOM, 17 October 1994.
18. McDiarmid, J., *Special Mission Ship Management*, MSC Briefing Slide, 4 February 1996.
19. Military Sealift Command Briefing Slide, Subj: Special Mission Ship Operations, Special Mission Ships are Best Operated by MSC, 13 March 1995.
20. Interview between M. Van Vleck, N3, MSCPAC and author, 5 February 1996.
21. Interviews between R. Arntzen, Special Mission Ships East, MSCLANT and author, February 1996.
22. Military Sealift Command, DYNCORP Award Contract N62387-94-C-4001, 27 June 1994.
23. Interview between T. Harper, N3132, G. Madden, N3512, Naval Oceanographic Office, and author, 31 January 1996.
24. Interview between P. Hanson, N4B, Commander, Naval Meteorology and Oceanography Command, and author, 30 January 1996.
25. Interview between D. Powell, N35P, Naval Oceanographic Office, and author, 1 February 1996.
26. Interviews between J. McDiarmid, Program Manager for Special Mission Program (PM-2), Military Sealift Command, and author, February 1996.

27. General Accounting Office, Report to the Ranking Minority Member, Subcommittee on Oversight of Government Management and the District of Columbia, Committee on Governmental Affairs, U.S. Senate, GAO/NSIAD-96-41, *Military Sealift Command, Weak Controls and Management of Contractor-Operated Ships*, Government Printing Office, Washington, D.C., December 1995.

APPENDIX. DEFINITIONS

These definitions related to measures are provided in support of Chapter IV.

CASREP Casualty Report System. CASREPs are only submitted for degraded equipment, all others are assumed to be fully operational. It uses a rating scale with C ratings of C-1 through C-4. C ratings with a higher suffix are worse. C-4 is non-operational and affects ship's mission.

MOVREP Movement Report. MOVREPs are submitted upon the ship's arrival, departure, when a change of destination is made or during Panama or Suez Canal transit.

MRDE Mission Related Deck Equipment. MRDE consists of winches, A-frames, and other specialized deck handling equipment which is used to carry out NAVOCEANO's survey efforts.

SAMM Shipboard Automated Maintenance Management system. SAMM is a computer program used in documenting shipboard maintenance actions. It also contains a database holding maintenance actions and procedures, shipboard equipment configuration file, as well as other maintenance related information.

SORTS Status of Resources and Training System. SORTS causes unit commanders to assess their commands in four areas: personnel, training, quantity of supplies, and equipment condition. It utilizes a rating scale from C-1 (fully capable in an area) to C-4 (not capable).

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center 2
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218
2. Dudley Knox Library 2
Naval Postgraduate School
411 Dyer Road
Monterey, CA 93943-5101
3. Director 1
Defense Logistics Studies Information Exchange . . .
U.S. Army Logistics Management College
Attn: ATSZ-DL
Fort Lee, VA 23801-6043
4. Commander 1
Military Sealift Command
Attn: N00
Washington Navy Yard, Bldg. 210
901 M Street SE
Washington, DC 20398-5540
5. Commander 1
Naval Meteorology and Oceanography Command
Attn: N00
1020 Balch Boulevard
Stennis Space Center, MS 39529-5005
6. Commander 1
Naval Oceanographic Office
Attn: N00
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001
7. Commander 1
Military Sealift Command
Attn: PM-2, Mr. Jim McDiarmid
Washington Navy Yard, Bldg. 210
901 M Street SE
Washington, DC 20398-5540
8. Commander 1
Naval Oceanographic Office
Attn: N35, CDR D. Smith
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001

9. Commander 1
Military Sealift Command, Atlantic
Attn: Ms. Renee Arntzen
Military Ocean Terminal, Bldg. 42
Bayonne, NJ 07002-5399

10. Commander 1
Military Sealift Command, Pacific
Attn: Mr. Michael Van Vleck
Bldg. 310, Naval Supply Center
Oakland, CA 94625-5010

11. Commander 1
Naval Oceanographic Office
Attn: N3512, Mr. George Madden
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001

12. Commander 1
Naval Oceanographic Office
Attn: N3132, Mr. Tom Harper
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001

13. Commander 1
Naval Oceanographic Office
Attn: N35P, Mr. Dave Powell
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001

14. Commander 1
Naval Meteorology and Oceanography Command
Attn: N4B, Mr. Peter Hanson
1020 Balch Boulevard
Stennis Space Center, MS 39529-5005

15. Professor William R. Gates (Code SM/Gt) 1
Naval Postgraduate School
Monterey, CA 93943-5103

16. Professor David G. Brown (Code SM/Bz) 1
Naval Postgraduate School
Monterey, CA 93943-5103

17. Professor Linda Wargo (Code SM/Wg) 1
Naval Postgraduate School
Monterey, CA 93943-5103

18. Professor Lee Edwards (Code SM/Ed) 1
Naval Postgraduate School
Monterey, CA 93943-5103

